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Annual Actual Evapotranspiration: global distribution and variation with land-cover type

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The process of evapotranspiration (ET) plays a critical role in several earth system processes including the energy, water and carbon cycles. To date, it has not been clearly characterized how ET rates are linked with individual land-cover (LC) types. LC type is an important driver of ET, yet the global distribution of ET by LC and the related physical variables are uncertain. The lack of quantitative understanding of how global ET varies with land-cover creates several uncertainties regarding how earth system processes will change alongside ongoing anthropogenic land-cover transformation.

Here we apply statistical models to a new global ET database (GETA 2.0) to advance our current knowledge of how annual actual ET varies with LC type. The database contains point estimates of ET rates taken from published sources and are explicitly categorized by LC type. Sixteen LC types are classified, including potential and anthropogenically disturbed LCs. We derive global fields of ET for each LC using linear mixed effects models which use elevation, location and overlying meteorology as external regression variables.

Our high resolution global fields of ET by LC resolves the spatial distribution of ET across the globe. We show that ET has a unique pattern in its global distribution for different LC types which is significantly linked to physical variables. Particularly, we find that air temperature, wind speed, and short wave radiation are the strongest drivers of ET variability as evidenced by statistical model selection. ET and short wave radiation are found to have a consistent statistical relationship with ET, whereas the relationships between ET, temperature and wind speed vary significantly with LC. In the talk, we discuss these findings and their implications for ongoing anthropogenic LC transformation, as well as the properties of the database, its spatial coverage, and uncertainties. The GETA 2.0 database will serve as a basis for furthered investigations into global ET dynamics.